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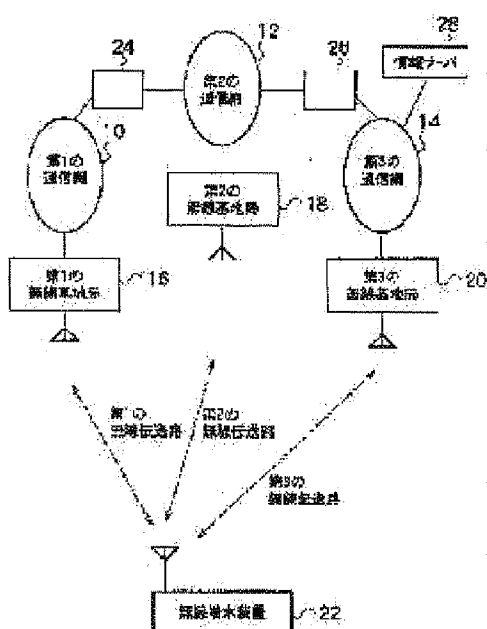
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## (54) RADIO TERMINAL AND RADIO COMMUNICATION SYSTEM



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a radio terminal that automatically switches a connected destination radio communication system depending on the contents of an application, a communication state, a state of a user, and a surrounding environmental condition or the like.

SOLUTION: The radio terminal 22 that is connectable to each of communication networks 10, 12, 14 adopting different communication systems is provided with an optimum radio transmission channel selection means that can select an optimum radio transmission channel

at any time on the basis of a prescribed radio transmission channel selection criterion among radio base stations 16, 18, 20 in the case of communication with any of the communication networks 10, 12, 14.

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## CLAIMS

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### [Claim(s)]

[Claim 1] It is two or more radio communications systems of each and a connectable radio terminal which adopt a different communication method, When communicating between either of said two or more radio communications systems, A radio terminal characterized by having the optimal radio transmission line selecting means selectable at any time for optimal radio transmission line based on a predetermined radio transmission line selection criterion from inside of two or more radio transmission lines formed between base transceiver stations of each of two or more of said radio communications systems.

[Claim 2] The radio terminal according to claim 1 characterized by having further the optimal communication destination unit selecting means selectable at any time for optimal communication destination unit based on a predetermined communication destination unit selection criterion from inside of two or more communication destination units connected to said each of two or more radio communications systems.

[Claim 3] The radio terminal according to claim 2, wherein connection with said communication destination unit is made via at least two of said two or more radio communications systems.

[Claim 4] From said two or more radio transmission lines and inside of a radio communications system, based on a predetermined connection path selection criterion, The radio terminal according to claim 3 having further an optimal non-wire diameter way selecting means selectable at any time for optimal radio transmission line and a radio communications system which are used for connection with said communication destination unit.

[Claim 5] Said radio transmission line selection criterion, a communication destination unit selection criterion, and each connection path selection criterion A state of said radio terminal, a situation of a user of said radio terminal, a communication content between said radio terminal and said communication destination unit, expense which a situation of said communication destination unit, a state of said radio transmission line, and communication between said radio terminal and said communication destination unit

take or power consumption, and \*\* -- the radio terminal according to claim 4 containing at least one.

[Claim 6]A radio communications system comprising:

A radio terminal which has a display screen.

The 1st communications network provided with the 1st base transceiver station that forms the 1st radio transmission line between these radio terminals.

A detector with which said radio terminal detects a gravity direction including the 2nd communications network provided with the 2nd base transceiver station that forms the 2nd radio transmission line that has low-speed access speed from said 1st radio transmission line between said radio terminals.

A means to judge correlation of a display direction of said display screen, and a look of a user of said radio terminal based on a detection result from this detector, and a means to choose with any of said 1st and 2nd base transceiver stations it connects based on a decision result from this judging means.

[Claim 7]When judged with a display direction of said display screen and look of said determination means of said user corresponding, The radio communications system according to claim 6 choosing connection with said 1st base transceiver station, and choosing connection with said 2nd base transceiver station when judged with a display direction of said display screen and said user's look not being in agreement.

[Claim 8]The 1st communications network that is a public network and was provided with the 1st base transceiver station, and the 2nd communications network that is the Local Area Networks which adopt the same communication method as this 1st communications network, and was provided with the 2nd base transceiver station, To said each of 1st and 2nd base transceiver stations, including a connectable radio terminal said each of 1st and 2nd base transceiver stations A radio communications system, wherein it notifies identification information peculiar to said each of 1st and 2nd base transceiver stations, and said radio terminal identifies a connection destination base transceiver station and chooses optimal connection destination base transceiver station by the notice of said identification information in the case of communication with said radio terminal.

[Claim 9]The radio communications system according to claim 8, wherein said radio terminal is further provided with a means to acquire position information on said radio terminal.

[Claim 10]A communications network provided with a base transceiver station, this base transceiver station and the 1st connectable radio terminal, this 1st radio terminal, and connection are possible, And data held inside said 2nd radio terminal including said

base transceiver station and the 2nd radio terminal that is not connectable, A radio communications system, wherein data which was once held and was further \*\*\*\*\* (ed) this one inside said 1st terminal unit by connection between said 1st and 2nd radio terminals is sent out to said communications network by connection between said 1st radio terminal and a base transceiver station.

[Claim 11] The radio communications system according to claim 10, wherein a radio transmission line which said 2nd radio terminal is arranged outside a communications area of said base transceiver station, or was formed between said base transceiver stations is intercepted.

[Claim 12] A communications network provided with a base transceiver station, this base transceiver station and the 1st connectable radio terminal, this 1st radio terminal, and connection are possible, And data sent out from said communications network including said base transceiver station and the 2nd radio terminal that is not connectable, By connection between said base transceiver station and the 1st radio terminal, it is once held inside said 1st terminal unit, and this one further \*\*\*\*\* (ed) data, A radio communications system characterized by being sent out to said 2nd radio terminal by connection between said 1st and 2nd radio terminals.

[Claim 13] The radio communications system according to claim 12, wherein a radio transmission line which said 2nd radio terminal is arranged outside a communications area of said base transceiver station, or was formed between said base transceiver stations is intercepted.

[Claim 14] A radio communications system which is provided with the following and characterized by said connection destination selecting means choosing a connection destination of said radio terminal when an emergency signal from said radio terminal transmitted via either of said base transceiver stations is received.

A communications network provided with two or more base transceiver stations.

A radio terminal in which said each of base transceiver station and connection are possible.

A means which is provided with a table where information which pinpoints two or more connection destinations of each of said radio terminal specified beforehand was indicated, and includes a connection destination selecting means which chooses a connection destination of said radio terminal with reference to this table by which said radio terminal supervises a condition of a user of said radio terminal at any time.

A means to send out an emergency signal when this user detects it as it being in a dangerous state.

[Claim 15] The radio communications system according to claim 14, wherein said

connection destination means is formed in a gateway server connected between said base transceiver station grounded in said user's home, and said communications network.

[Claim 16]The radio communications system according to claim 14, wherein said connection destination means is formed in a service provider connected to said communications network.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a radio terminal, a radio communications system, and a wireless communication method.

[0002]

[Description of the Prior Art]As for the conventional radio communications system, communication was performed using separate frequency for every system. For this reason, a radio terminal is a terminal peculiar to the radio communications system with which each is used.

It is connectable only with a corresponding radio communications system.

On the other hand, although the radio communication equipment of two or more kinds was beforehand built in depending on the terminal and some were connectable with two or more radio communications systems, at once, it was able to connect only with one system. The change of radio communication equipment itself was performed by the hand control of the user of a radio terminal.

[0003]In the radio communications system shown in drawing 18, the radio terminal 1004 which can be connected without PHS network 1000 and PDC network 1002 and which is called a dual mode terminal is used two communications networks and here. The thing radio terminal 1004 is equipped with the indicator 1006, the ten key 1008, the radio antenna 1010 for PHS network 100, the radio antenna 1012 for PDC network 1002, and \*\*. PHS network 1000 and PDC network 1002 -- respectively -- being alike -- the base transceiver station 1014-1016 is connected and wireless connection of the radio terminal 1004 is carried out to PHS network 1000 and PDC network 1002 via each base transceiver station 1014-1016. PHS network 100 and PDC network 1002 are connected with the Internet 1020 which is a public network via the access server 2109 corresponding to each.

[0004]The radio terminal 1004 can perform the terminal 1022 and voice call of the communication destination which is connected to PHS network 1000 using the radio antenna 1010, and is connected with PHS network 1000, for example. It is also possible to perform the terminal 1024 and voice call of the communication destination which is connected to PDC network 1002 using the radio antenna 1012, and is connected with PDC network 1002. A data telecommunication line can be established between the access servers 1018, and the desired information server (WWW server) 1026 can also be accessed via the Internet 1020. The information in the information server 1026 will be transmitted to the radio equipment terminal 1004 via either PHS network 1000 or PDC network 1002, and it will be displayed on the indicator 1006 of the radio terminal 1004.

[0005]In the above-mentioned case, it is chosen by the input by the user who used the ten key 1008 etc. with any of the connection destination of the radio terminal 1004, i.e., the inside of PHS network 1000 and PDC network 1002, it connects. That is, the selection is based on a user's volition. Therefore, for example, when a user performs voice communication, it just depends on a user's determination whether a service area chooses PDC network 1002 which can be adapted also for high-speed movement widely, or PHS network 1000 with quick access speed of data communications is chosen. For this reason, when carrying out a voice call for example, as a result of choosing PHS network 1000, there was a case where that communication will be cut during movement, or PDC network 1002 was chosen as data communications, and the top where a data transmission rate is low was highly asked also for a fee as a result.

[0006]In PC device 1028 shown in drawing 19, both the PHS data communication card 1030 and the wireless LAN card 1032 connect with the PCMCIA card SUROAAI conte 1028a of PC device 1028. It connected with PHS terminal 1034 and the PHS data communication card 1030 has connected the wireless LAN card device 1032 with the main phone 1036 via the antenna section 1032a. PC device 1028 accesses the information server (WWW server) 1046 connected to the Internet 1044 via the wireless LAN card 1032, the main phone 1036, Ethernet 1038, the private network 1040, and the gateway 1042. Or it is also possible to access the information server 1046 via the PHS data communication card 1030, PHS terminal 1034, the base station 1048, PHS network 1050, and the access server 1052. It can communicate also with the terminal 1054 of a communication destination connected to PHS network 1050.

[0007]With any of the connection destination of PC device 1028 of drawing 19, i.e., the inside of the private network 1040 and PHS network 1050, it connects. being displayed on the display device of PC device 1028 -- the private network 104 and PHS network 1050 -- it is determined by it being alike, respectively and clicking on the corresponding

icon 1028b by the mouse cursor 1028c. The information on the information server 1046 is also downloadable by soft operation of the WWW browser in PC device 1028, etc.

[0008]In this case, even if it is, radio is performed like the case where it is shown in above-mentioned drawing 18 because the user of PC device 1028 chooses the connection destination of PC device 1028. The once selected connection destination cannot be automatically switched during communication. For this reason, even if it is a case where PC device 1028 connected to the private network 1040 needed to move indoors for example, therefore connection needs to be switched to PHS network 1050, once it cuts communication with the private network 1040, it is necessary to carry out re connection to PHS network 105. Therefore, complicated operation will be required of a user.

[0009]As a problem [ / above-mentioned drawing 18 and in the case of / both / drawing 19 ], when switching two walkie-talkies, since each walkie-talkie is independent, there is a problem that the physical layer of a walkie-talkie and a MAC layer are required respectively. In the case of drawing 19, since the logic LSI for data communications, etc. were required for both, there were also problems, like the weight of a walkie-talkie, power consumption, and price cost are needed by about two sets.

[0010]Although the separate system has been conventionally built for every radio frequency, in the 2.4GHz bandwidth, the frequency band with two or more same systems called not only IEEE802.11 but HomeRF and Bluetooth is used. However, like the above, since the apparatus of each system was independent, even if it was the same frequency band, as shown in drawing 19, it needed to connect two or more radio terminals. And in 5.2 GHz bands or 5.3 GHz bands, two or more wireless systems are likely to share frequency similarly.

[0011]Since the change of the walkie-talkie of a radio terminal is performed by a user's manual entry, the radio communications system connected whenever a place changes must be changed. When communication contents differed also in identical places, the walkie-talkie needed to be switched too. Since two or more walkie-talkies were not able to be chosen simultaneously, communication of two or more contents referred to as telephoning was not able to be realized looking at a picture.

[0012]

[Problem(s) to be Solved by the Invention]This invention solves such a technical problem and an object according to the contents of application, a communicative state, a user's condition, a surrounding environmental condition, etc. of this invention is to provide a switchable radio terminal for the radio communications system of a connection destination automatically.

[0013]

[Means for Solving the Problem]In order to solve an aforementioned problem, this invention is two or more radio communications systems of each and a connectable radio terminal which adopt a different communication method, When communicating between either of said two or more radio communications systems, From inside of two or more radio transmission lines formed between base transceiver stations of each of two or more of said radio communications systems, it is characterized by being a radio terminal provided with the optimal radio transmission line selecting means selectable at any time for optimal radio transmission line based on a predetermined radio transmission line selection criterion.

[0014]According to this invention, it becomes possible to change a change of a radio communications system of a connection destination automatically according to a user's condition etc. For this reason, it can reduce and the troublesome operation by a user can operate application appropriately.

[0015]

[Embodiment of the Invention]With reference to drawings, an embodiment of the invention is described below. In the statement of the following drawings, same or similar numerals are given to the same or similar portion. Below, the radio communications system and wireless communication method which explain the radio terminal concerning this invention first, next start this invention are explained using six embodiments.

[0016](Radio terminal concerning this invention) Drawing 1 is an outline lineblock diagram showing the radio communications system containing the radio terminal concerning this invention. The 1st communications network 10 with which this radio communications system intercommunicates, and the 2nd and 3rd communications networks 12 and 14 that make public connection, the 1st, 2nd, and 3rd communications networks 10, 12, and 14 -- with the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 that were alike, respectively and were connected. It is \*\* constituted with the radio terminal 22 in which wireless connection is possible by the communications networks 10, 12, and 14 corresponding to each via the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20. The interface 24 is connected between the 1st communications network 10 and the 2nd communications network 12, and the interface 26 is connected between the 2nd communications network 12 and the 3rd communications network 14.

[0017]the radio terminal 22 concerning this invention -- the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 -- it is alike, respectively, and it receives and radio is realized. the radio terminal 22 -- the 1st, 2nd, and 3rd base stations 16, 18, and 20 -- it has at least a wireless interface in which each and communication are possible. usually,



each base stations 16, 18, and 20 -- each of not all communication available area has lapped. Therefore, the radio terminal 22 chooses from among the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 the base transceiver station which can establish communication, and chooses the most suitable channel out of the communication performance which application requires. In drawing 1, the base transceiver station 16 Bluetooth, wireless LAN and the base station of the radio which realizes intercommunication of a short distance like HomeRF, and the base transceiver station 18, The base station of the radio which can perform communication which is a base station of a mobile radio communication network for the public like PDC, and was stabilized also to high-speed movement like the movement speed of a car, and the base transceiver station 109, It is a base station of the radio for the public who provide movement about [ like high speed movement access ] PHS or walking speed.

[0018]Next, the layer composition of the radio terminal 22 shown in drawing 1 is explained. Drawing 2 is a figure showing the 1st example of the layer composition of the radio terminal 22 of drawing 1. This 1st example is an example about the selection method of the radio equipment at the time of using a 2.4GHz bandwidth for a wireless section. At this 1st example, they are Bluetooth, HomeRF, and IEEE802.11 (IEEE802.11b is also included.). Hereafter, the physical layer and the MAC layer corresponding to each are constituted independently in a similar manner, respectively. Radio switching control middleware (RLC), The communication quality demanded in application (AP) by changing radio equipment is embodied, and further, the QoS Management Department performs resending control and a flow control to an LLC layer or a TCP layer so that the quality which user application requires can be secured. [0019]Drawing 3 is a figure showing the 2nd example of the layer composition of the radio terminal 22 of drawing 1. In this 2nd example, it has an application controlling control section which manages the QoS requirements of user application, and radio supervisory control middleware (RLC). the wireless system which connects the physical layer and a MAC layer flexibly using the same hardware like a software walkie-talkie -- it is switchable. Based on the QoS information demanded from an application controlling control section, radio supervisory control middleware (RLC) controls a software walkie-talkie to control a software walkie-talkie and to fulfill the QoS information demanded. In this case, the walkie-talkie connected can consider Bluetooth, HomeRF, and IEEE802.11, for example.

[0020]Drawing 4 is a figure showing the 3rd example of the layer composition of the radio terminal 22 of drawing 1. In this 3rd example, it has a data link, IP, TCP/UDP, etc. for every systems, such as Bluetooth, HomeRF, and IEEE802.11, as the physical layer.

The application controlling control section which performs the communication quality demand from user application, It has interface switching control middleware which changes the device which supervises a terminal or a user's condition by cell, a sensor, etc., and the interface formed for every system. The communication quality as which user application requires an application controlling control section, Suitable radio equipment is chosen by changing the system interface which communication middleware connects according to the algorithm defined beforehand based on the information which shows the terminal acquired from a cell, a sensor, etc., or a user's condition.

[0021]Drawing 5 is a figure showing the 4th example of the layer composition of the radio terminal 22 of drawing 1. This 4th example is an example about the selection method of the radio equipment at the time of using a 5GHz bandwidth, for example. Although this 4th example comprises an application controlling control section, radio supervisory control middleware (RLC), etc., a MAC layer realizes the difference between systems with software. The object for 5.2 GHz bands and the object for 5.3 GHz bands are provided in the physical layer, respectively. An application controlling control section transmits the communication quality which application requires to a radio supervisory control middleware part (RLC). The radio equipment connected in a radio supervisory control middleware part is determined, the system which connects a MAC layer is made to correspond, and it connects with the required physical layer and a desired wireless system is realized.

[0022](A 1st embodiment), next a 1st embodiment of this invention are described. Drawing 6 is an outline lineblock diagram showing the radio communications system concerning a 1st embodiment of this invention. In drawing 6, as a communications partner of the radio terminal 22, to the 1st communications network 10. The information server 34 which comprises multimedia information containing an animation and a still picture is connected to the information server 30 constituted by the individual accumulation information of e-mail etc., the information server 32 constituted by advertisement information at the 2nd communications network 12, and the 3rd communications network 14, respectively. The radio terminal 11 will choose a communication destination from among these information servers 30, 32, and 34.

[0023]Next, operation of a 1st embodiment of this invention is explained. The radio terminal 22 First, battery residual quantity of the radio terminal 22, performance of a display screen, Based on the version information etc. of the request content from a user, the communication quality which application requires, and application, the information servers 30, 32, and 34 containing the contents which a user demands are chosen, and

the communications networks 10, 12, and 14 connected from the result of the selection are determined. For example, the case where the multimedia information containing an animation is received from the information server 34 is considered. There is battery residual quantity of enough of the radio terminal 22, and when the display of the radio terminal 22 can display a high definition animation, the communication middleware of the radio terminal 22 performs communication with the information server 34 via the 3rd communications network 14. The information provided from the information server 34 is mass information which makes an animation a subject, and in order to carry this, the radio terminal 22 connects with the base transceiver station 20 via the 3rd radio transmission line. When the application of the radio terminal 22 requires a mail transfer simultaneously from the information server 30, Or when the effect of lowering telex rate gold by receiving advertisement information from the information server 32 is expected, information is received from the information servers 30 and 32 via the interfaces 24 and 26 if needed.

[0024]When use of the 2nd radio transmission line where access speed is lower than the 3rd radio transmission line is enough, the communication middleware of the radio terminal 22 performs communication with the information server 34 via the 2nd advantageous radio transmission line and 2nd communications network 12 from cost required for communication, and the field of power consumption. In such a case, when there is little battery residual quantity, the contents of information transmission which application requires occur for the reasons of being out of the area of the 3rd base transceiver station 20, for example, the case of access speed less than the 3rd communications network 14, or when moving at high speed.

[0025]When it can be connected with the base transceiver station 16 of the 1st communications network 10 by intercommunication, the communication middleware of the radio terminal 22 performs communication with the information servers 30, 32, and 34 via the 1st radio transmission line and 1st communications network 10. Since it does not necessarily generate in intercommunication whenever telex rate gold is generally communication, it enables this to realize cheap communication.

[0026]Since power consumption becomes large in that a transmission system [ be / access speed / generally / a high speed ] is the more nearly same and the transmission quality, these selections act effective in extension of the operating time of the radio terminal 22 by battery operation, for example. In communication yard radio, since the communication range is shorter than public radio, the operating time of the terminal by battery operation is extensible similarly by communicating by making a transmission output small.

[0027]Here, the concrete composition of the radio terminal 22 shown in above-mentioned drawing 1 and drawing 6 is explained. Drawing 7 is a block diagram showing the composition of the radio terminal 22. This radio terminal 22 The communication control part 2201 and radio receiving part 2202 a-2202 b-2202c, It is \*\* constituted with Battery Unit 2203, the acceleration sensor 2204, the position sensing device 2205, the terminal state judgment part 2206, the display 2207, the input device 2208, the user application 2209, and wireless transmission part 2210 a-2210 b-2210c.

[0028]Next, the receiving operation of the radio terminal 22 of drawing 7 is explained using drawing 8. Drawing 8 is a flow chart which shows the procedure of the receiving operation of the radio terminal 22 of drawing 7. First, at first, the communication control part 2201 reads radio receiving information from radio receiving part 2202a-2202b-2202c, and judges an usable walkie-talkie from the radio receiving information (Step S101). then, the display 2207, the input device 2208, and the user application 2209 -- each state is read and the candidate of the walkie-talkie actually used out of an usable walkie-talkie is determined (Step S102). usually, the display 2207, the input device 2208, and the user application 2209 -- once the display state information, input device state information, and demand QoS information which are outputted from each are stored in enclosure, such as a memory which is not illustrated, they will be read into the communication control part 2201.

[0029]Next, the terminal state judgment part 2206 acquires acceleration information and position information from the acceleration sensor 2204 and the position sensing device 2205, and judges whether it is in the state where the radio terminal 22 can operate (Step S103). Usually, the terminal state determination information is once recorded on enclosure, such as a memory which is not illustrated. And based on the terminal state determination information stored in the enclosure, the communication control part 2201 judges the operating state of the radio terminal 22, i.e., the operating state of the user of the radio terminal 22, and judges the receiving performance required of the radio terminal 22 (Step S104). For example, in the state where the user is not looking at the screen, reception of a real time image is unnecessary. In this case, what is necessary is to reduce access speed and just to receive image data.

[0030]Next, the communication control part 2201 performs narrowing down of the walkie-talkie to be used based on the decision result of Step S104 (Step S105). The use candidate of a walkie-talkie may be not only one but plural. However, when there are more than one, prioritization shall be carried out by the algorithm etc. which were defined beforehand. And choose one from the walkie-talkies which are use candidates (Step S106), and the communication control part 2201, It is judged by referring to the

radio receiving information from radio receiving part 2202a-2202b-2202c whether it can communicate by the selected candidate (Step S107). And if there is the next candidate further (step S108YES) and it is when the candidate does not satisfy conditions (step S107NO), it will return to the above-mentioned step S106. On the other hand, if there is no next candidate (step S108NO), data receiving will be stopped (Step S109) and receiving operation will be ended here.

[0031]If the walkie-talkie selected at Step S107 satisfies conditions (step S107YES), it will determine as a walkie-talkie to be used (Step S110). And if there is the next candidate further (step S111YES), it will return to the above-mentioned step S106. If there is already no next candidate (step S111NO), on the other hand, the communication control part 2201, A receiver control signal is transmitted to radio receiving part 2202 a-2202 b-2202c, the optimal walkie-talkie for reception is chosen (Step S112), data receiving is started (Step S113), and the receiving operation of the radio terminal 22 is ended.

[0032]Next, the send action of the radio terminal 22 of drawing 7 is explained using drawing 9. Drawing 9 is a flow chart which shows the procedure of the send action of the radio terminal 22 of drawing 7. The communication control part 2201 checks first whether the data which should be transmitted exists at first (Step S201). And if there is no send data (step S202NO), it judges whether the waiting for send data is continued by the timer or other means, and in continuing, it will return to (Step S213YES) and Step S201. the case where it does not continue -- (Step S213NO) -- data transmission is stopped promptly (Step S210), and the send action of the radio terminal 22 is ended.

[0033]On the other hand, if there is send data (step S202YES), the communication control part 2201 will read terminal state determination information, and will judge whether the radio terminal 22 is an operation enabling way (Step S203). Battery residual quantity information may be acquired from the battery 2203 at this step S203. Then, it is judged whether the radio terminal 22 is in the state in which a send action is possible (Step S204). For example, even if it is a case where the user application 2209 desires real time transmission of the camera image by a user, When a user is judged to be in a walking condition at the above-mentioned step S203, it judges that a right picture cannot be transmitted (step S204NO), and operation of not performing broadband communication required for a picture signal (Step S210) can be considered. Also when the residue of a battery is judged to be few from battery residual quantity information, it may be judged that a send action is impossible. And a send action is ended here.

[0034]On the other hand, when judging that the radio terminal 22 is in the state in

which a send action is possible, (Step S204YES) and the communication control part 2201 read radio receiving information (Step S205), and determine the selected candidate of a walkie-talkie (Step S206). It is because determining the selected candidate of a walkie-talkie based on radio receiving information is usually performed by a pair here to the base transceiver station where transmission and reception are the same, so it is thought that transmission using the radio transmission line which cannot receive notice information from a base transceiver station cannot be performed. However, in the case of the hybrid radio communications system which uses a different walkie-talkie between transmission and reception, for example, Step S205 which is check operation of a receive state can also be omitted.

[0035]And one is chosen from the walkie-talkies which are selected candidates (Step S207), and it judges whether the walkie-talkie is ability ready for sending, and if there are (Step S208NO) and the next candidate further when it cannot transmit (step S209YES), it will return to the above-mentioned step S207. On the other hand, if there is no next candidate (step S209NO), data transmission will be stopped (Step S210) and a send action will be ended here. The judgment of the above-mentioned step S208 should just judge whether for example, the receiver used as a pair can receive the notice information transmitted from a base transceiver station.

[0036]On the other hand, in being ability ready for sending, it opts for use of (Step S208YES) and its walkie-talkie (Step S211), and data transmission is started (Step S212), and the send action of the radio terminal 22 is ended. Not only transmission but reception may be performed simultaneously.

[0037]What is necessary is here, just to perform prioritization of the selected walkie-talkie in the receiving operation of above-mentioned drawing 8, and the send action of drawing 9 as follows, for example. Drawing 10 is a figure for explaining the method of the prioritization of the selected walkie-talkie. The example of drawing 10 (a) sets the amount of commo data to M, and The access speed of the channel 1, this case where time unit prices are the cases where a, A, the access speed of the channel 2, and time unit prices are [ b, B, the access speed of the channel 3 and time unit prices ] c and C, respectively -- each channels 1, 2, and 3 -- each communication cost is set to  $M (A/a)$ ,  $M (B/b)$ , and  $M (C/c)$ . Therefore, what is necessary is just to perform dominance ranking of a channel in the cheap order, if communication cost is cheap in order of the channels 2, 1, and 3.

[0038]The channel 1 is a case where the time charging system with which telex rate gold is determined according to time as for the example of drawing 10 (b), the packet charging system with which telex rate gold is determined according to a packet number

as for the channel 2, and the channel 3 are flat-rate fees. supposing telex rate gold of the channel 2 is 1 about  $p$  and average packet length per packet here -- marginal cost required for data transmission -- the channels 1, 2, and 3 -- it is alike, respectively, it sets and can calculate with  $M(A/a)$ ,  $p(M/1)$ , and 0. In this case, what is necessary is just to attach the dominance ranking of channel selection to that order, if communication cost is cheap in order of the channels 3, 2, and 1.

[0039]By having a table of such calculation in the inside of a terminal, it becomes possible to choose the cheap radio channel of cost easily.

[0040]Ranking of the prioritization of such a channel can also be carried out using the factor of not only communication cost like the above-mentioned example but others. For example, what is necessary is to give priority to the channel of low power consumption more, and just to determine a channel, when in the case of a personal digital assistant there is much battery residual quantity, priority is given to cost, a channel is determined and battery residual quantity has decreased. As a channel deciding method of low power consumption, by acquiring not only access speed but the received field intensity information from a base station, required transmission power control to a base station can be performed, and a base station can also choose the neighborhood and a radio channel with little power consumption most.

[0041]It is also possible to choose a base station according to the not selection but contents of contents by a pan and cost like the above-mentioned example. For example, in the case of the fixed form contents expected to have fitted in a certain amount of [ data volume ] range in the example of drawing 10 (c). In the case of specific type contents, such as real time image transmission in which fee collection uses the channel 1 of a fixed amount system for, and the range of data volume does not become settled, Although telex rate gold is cheap among the channels of the meter-rate system [ fee collection ], area gives priority to and chooses the narrow channel 3, and subsequently, although telex rate gold is comparatively high-priced than the channel 3, it searches and chooses the large channel 2 of a communications area.

[0042]By equipping a communication control part with such a selection algorithm, the power consumption of a terminal can be controlled and small amount-ization of the miniaturization of a terminal, huge-izing of hour corresponding, and telex rate gold can be realized.

[0043](A 2nd embodiment), next a 2nd embodiment of this invention are described. This 2nd embodiment shows the concrete example of application of the radio communications system concerning a 1st above-mentioned embodiment. Drawing 11 is an outline lineblock diagram of the communications system concerning a 2nd embodiment of this

invention.

[0044]In drawing 11 (a), the communications system of this 2nd embodiment, Connect with the 1st communications network 36, the 2nd communications network 38, and the 1st communications network 36, and The 1st base transceiver station (for example, CDMA radio base station) 40 in which high-speed transmission is possible, It connects with the 2nd communications network 38, and is \*\* constituted with the radio terminal 44 which carries out radio between the 2nd base transceiver station (for example, base transceiver station of PHS) 42 that performs transmission [ low speed / base transceiver station / 40 / 1st ], and the 1st and 2nd base transceiver stations 40 and 42. The radio terminal 44 is provided with the acceleration sensor 4403 formed in parallel with the antenna 4401, the display 4402, and the display 4402. And the radio terminal 44 forms the high-speed radio transmission line 46 between the 1st base transceiver station 40, and forms the low-speed radio transmission line 48 between the 2nd base transceiver station 42.

[0045]Drawing 11 (a) shows the state where the user of the radio terminal 44 is just looking at the picture currently displayed on the display 4402 of the radio terminal 44. In this case, the acceleration sensor 4403 with which the radio terminal 44 was equipped will be located in the direction that the radio terminal 44 detects a gravity direction. Thereby, it can be detected as the acceleration sensor 4403 having the display 4402 of the radio terminal 44 in upward directions. Because, the personal digital assistant with a screen display will usually be located below a user's eye line, and it will be viewed and listened to the screen. Therefore, if it detects that terminals are upward directions, it will become possible to judge that the user is looking at the screen. And if a user is a case where it is viewing and listening to a real time image, for example, the radio terminal 44 will form the high-speed radio transmission line 46 between the 1st base transceiver station 40, and will make it possible to display a real time image in the state where the screen is seen that a user does not have stress.

[0046]On the other hand, as shown in drawing 11 (b), when the display 4402 of the radio terminal 44 is placed for length or back, a user is usually considered not to see the screen. In this case, it is unnecessary to receive a picture in real time. Then, when detected as the radio terminal 44 being placed for length or back by the acceleration sensor 4403, communication of user data is connected to the 2nd base transceiver station 42 through the low speed radio channel 48. Data communications can be realized without this performing the big high-speed wireless communications of power consumption. For this reason, the battery specification ratio of the radio terminal 44 can be made small. In the case of drawing 11 (b), reduction of the further power



consumption is also possible by indicating the display 4402 an OFF state.

[0047]What is necessary is just to use ADXL202JC by analog DEBAISESU which is a two-dimensions type acceleration sensor as the acceleration sensor 4403 of drawing 11, for example. It is possible to detect the physical relationship over the gravity direction of a terminal with biaxial resultant acceleration in this acceleration sensor. When a terminal is in an acceleration-and-deceleration state, an exact gravity direction cannot be detected, but it is possible by turning this acceleration sensor in the direction of a three-dimensional eye, and extending it one more set further, to grasp the gravity direction in a three dimension more correctly.

[0048]The high-speed radio transmission line 46 is used only for the going-down link from the 1st base transceiver station 40 to the radio terminal 44, and it may be made for an uphill link to use the low-speed radio channel 48 in a 3rd embodiment of this invention. In this case, power consumption is made small more and a terminal price can be made cheap by the reduction of the number of parts of the radio terminal 44.

[0049](A 3rd embodiment), next a 3rd embodiment of this invention are described. This 3rd embodiment as well as a 2nd above-mentioned embodiment shows the concrete example of application of the radio communications system concerning a 1st above-mentioned embodiment. Drawing 12 is an outline lineblock diagram of the communications system concerning a 3rd embodiment of this invention.

[0050]In drawing 12, the radio terminal 50 shall receive at least the electric wave of the 1st base transceiver station 54 for home use installed in the house 52 in the house 52, and the 2nd base transceiver station 56 for the public installed out of the house 52. Although the radio terminal 50 in the house 52 is connectable with all of the 1st base transceiver station 54 and the 2nd base transceiver station 56 by channel switching, The 1st base transceiver station 54 has reported ID of the purport that it is a home base transceiver station in the house 52, in a part of the information channel, and the 2nd base transceiver station 56 presupposes it that ID of the purport that it is a base transceiver station for the public is similarly reported in a part of the information channel.

[0051]In this case, the radio terminal 50 can communicate the quality stable by giving priority to connection with the 1st base transceiver station 54, and further, in order that an electric wave may decline with the wall of the house 52, it becomes possible to decrease the radio wave interference to the exterior and to connect.

[0052]Since the same radio frequency is used when the radio terminal 50 moves outside from the inside of the house 52, when connecting with the 2nd base transceiver station 56, it can connect using the same transmission and reception circuit, and it becomes

possible to decrease a miniaturization and cost of a terminal.

[0053]The judgment of whether it is inside the house 52 or it is outside needed is possible by connecting with the 1st base transceiver station 54, when the receiving field intensity of the notice information of the 1st base transceiver station 54 is measured and the receiving field intensity of the 1st base transceiver station 54 exceeds a predetermined threshold. It is also possible to judge the inside and outside of a house from reference of the position information and map information of a terminal the method of using the surrounding illumination as an option, and by using GPS (positioning satellites).

[0054](A 4th embodiment), next a 4th embodiment of this invention are described. Drawing 13 is an outline lineblock diagram of the communications system concerning a 4th embodiment of this invention. Drawing 13 shows the case where it transmits indirectly to the server apparatus 74 by which the picture photoed by the digital camera device 62 was connected to the communications network 72.

[0055]First, the digital camera device 62 is located in the inside of the buildings 66, such as an art gallery and a hole, in drawing 13 (a). For this reason, the wireless radios built in the digital camera device 62 are in the outside of the circle of the communications area 70 of the base transceiver station 68 of the communications network 72, and cannot be directly connected with the base transceiver station 68. In such a case, the radio terminal 64 once receives the picture in the digital camera device 62, and accumulates it in the inside. Delivery of this picture may differ, for example, should just connect temporarily between the digital camera device 62 and the radio terminals 64 with the wireless system for base transceiver station 68 by Bluetooth. The radio terminal 64 is always in contact with the exterior of a user's body with shape like a wrist watch, for example.

[0056]Next, as shown in drawing 13 (b), the user of the radio terminal 64 goes from the building 66 outside, and moves into the communications area 70 of the base transceiver station 68. Under the present circumstances, the digital camera device 62 presupposes that it puts in and is carried in the metal bags 76. In this case, the digital camera device 62 is not connectable with the base transceiver station 68 by the radio attenuation produced with the metal bags 76. However, since the radio terminal 64 is a form which is visible to the exterior of the bodies, such as a wrist watch, it connects with the base transceiver station 68, and it can transmit the accumulation data from the digital camera device 62 to the server apparatus 74 via the communications network 72. It replaces with the server apparatus 74, and, of course, it does not matter even if it transmits to another communication terminal device.

[0057]When the digital camera device 62 does not have a contact which can be used for connection with the base transceiver station 68 according to a 5th embodiment of this invention, Or even if there is a contact and it is in the situation which cannot be transmitted directly, it becomes possible to perform asynchronous wireless data transmission to the base transceiver station 68 by going via the radio terminal 64.

[0058](A 5th embodiment), next a 5th embodiment of this invention are described. Drawing 14 is an outline lineblock diagram of the communications system concerning a 5th embodiment of this invention. In drawing 14, the 1st radio terminal 78 is a radio terminal provided with the display like PDA (Personal Didigal Assistent), for example. It shall always be exposed outside like a wrist watch connectable [ the 2nd radio terminal 80 ] with the 1st radio terminal 78 at both base transceiver stations 82.

[0059]Drawing 14 (a) shows the case where a user passes the automatic gate machine 84 of a station yard to the 1st and 2nd radio terminals 78 and 80. Here, although the data of the E-mail of addressing of the 1st to radio terminal 78, etc. exists from the information server 88, the 1st radio terminal 78 is contained in the bag, and presupposes that it cannot communicate with the base transceiver station 82 by radio attenuation. This is because communication becomes difficult for example, in the situation whose prospect is impossible in the case of high frequency like a 5GHz bandwidth. In such a case, with the 2nd easy radio terminal 80 of connection, the data of addressing of the 1st to radio terminal 78 is received, and it once accumulates in the memory storage of the 1st radio terminal 80.

[0060]And as shown in drawing 14 (b), the user can transmit the data once stored into the 2nd radio terminal 80 to the 1st radio terminal 78 within the rail car 90, and can display an animation etc. with the 1st radio terminal 78.

[0061](A 6th embodiment), next a 6th embodiment of this invention are described. Drawing 15 is a figure for explaining the communications system concerning a 6th embodiment of this invention, and it is a figure in which (a) shows the outline lineblock diagram, and (b) shows the composition of the gateway server of (a).

[0062]In drawing 15 (a), the user who carries the radio terminal 92 loses consciousness by an accident, and presupposes that a hospital cannot be called. In this case, a user detects that it is in a dangerous state, and notifies that information to a place required for an automatic target, and the radio terminal 92 performs help of rescue of a user.

[0063]It connects with the base transceiver station 94, and, specifically, the radio terminal 92 notifies an emergency signal to the gateway server 96, when a user's health condition is supervised and a dangerous state is detected. Although this uses the message ID of the kind which notifies danger, for example, it can notify the special

number according to not only a fixed number like No. 119 but the user's dangerous condition.

[0064]As shown in drawing 15 (b), inside the gateway server 96, an emergency call is displayed on the terminal 106 with user's family doctor's 102 call number with reference to the table 100 in the communication control part 98. Or with the call number of a fire department or the emergency center 108, an emergency call can be displayed on the communication terminal device 110, and an ambulance can be mobilized. It can be set up change a call destination according to the state of danger although it has ranked with the table 100 in this case in order of the call.

[0065]As for the gateway server 96, it is possible by calling the terminal 114 of the authorized personnel 112, such as a relative, via the base transceiver station 116 to also make the authorized personnel 112 notify of danger. furthermore -- not changing a call destination from the gateway server 96 on the table 100 -- the service provider 118 -- the communication end device 104 -- it may carry out by executing each function of a call by proxy.

[0066]Drawing 16 is a figure showing another composition of a 6th embodiment of this invention. By calling the call sign of the emergency contact set up beforehand via the base transceiver station 124, when the radio terminal 120 detects it as it being danger that the user breaks down from a place where one has gone with an accident, illness, etc. in drawing 16, the hospital 126, a fire department, and the emergency center 128 -- danger is notified to the terminal unit 134 via each communication end device 130. By seeing each terminal 134, a fire department, the emergency center official in charge 136, or the medical staff 138 detects a user's danger, and arranges mobilization of an ambulance, etc. promptly. This becomes possible to rescue a user. By notifying an emergency signal to the gateway unit 144 of the house 142 of the authorized personnel 140, such as a relative, the radio terminal 120 can display emergency intelligence on the user-terminal device 148 via the yard base transceiver station 146, and can tell the authorized personnel 140 about a user's danger.

[0067]In above-mentioned drawing 16, a user's position information can be known based on base station ID reported from the base transceiver station 124, for example, and it becomes possible to rescue promptly and correctly by displaying this on the terminal unit 134,148. In the radio terminal 120, do not search with the table of a call destination, but the service provider 150 has a table of a call destination, and the radio terminal 120, By notifying a user's dangerous condition to the service provider 150, the service provider 150 is able to call a fire department or the emergency center 128, the hospital 126, or the authorized personnel 140.

[0068]Drawing 17 is a block diagram showing above-mentioned drawing 15 and the example of composition of the radio terminal 92,120 of drawing 16. In drawing 17, this radio terminal The infrared sensor 152 and the camera device 154, The acceleration sensor 156, the pulse wave sensor 158, and the position sensing device 160, It has the health-care information storage part 162, the image processing portion 164, the user state judging part 166, the communication control part 168, the communication destination list 170, the communication processing part 172, the radio receiving part 174, and the wireless transmission part 176 at least.

[0069]In the radio terminal of drawing 17, based on the measurement information of the infrared sensor 152, or the picture signal of the camera device 154, the state of the face and eye of the user of this radio terminal, and the body is processed by the image processing portion 164, and the image processing signal which is that processing result is transmitted to the user state judging part 166. The user state judging part 166 inputs the acceleration signal from the acceleration sensor 156, the pulse wave information from the pulse wave sensor 158, and the position signal from the position sensing device 160, and judges the state of a user's body. The user state judging part 166 supervises the state of a user's body with reference to the health-care information stored in the health-care information storage part 162 if needed.

[0070]And the user state judging part 166 transmits the user state decision signal which shows a dangerous purport to the communication control part 168, when abnormalities and danger are detected in the state of a user's body. The communication control part 168 reads the communication destination list information containing call ID, such as a user's family doctor, from the communication destination list 170 which stores ID of a user's communication destination, and transmits a communication control signal to the communication processing part 172. the communication processing part 172 -- the radio receiving part 174 and the wireless transmission part 176 -- it is alike, respectively, a receiver control signal and a transmitter control signal are outputted, and transmission and reception of received data and send data are performed.

[0071]

[Effect of the Invention]According to this invention, the radio terminal which can change the change of the radio communications system of a connection destination automatically according to a user's condition etc. is realizable. For this reason, the change by a user becomes unnecessary and the user needs to perform a troublesome switching action. Automatic switching enables it to operate the application of a radio terminal more appropriately.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is an outline lineblock diagram showing the radio communications system containing the radio terminal concerning this invention.

[Drawing 2] It is a figure showing the 1st example of the layer composition of the radio terminal 22 of drawing 1.

[Drawing 3] It is a figure showing the 2nd example of the layer composition of the radio terminal 22 of drawing 1.

[Drawing 4] It is a figure showing the 3rd example of the layer composition of the radio terminal 22 of drawing 1.

[Drawing 5] It is a figure showing the 4th example of the layer composition of the radio terminal 22 of drawing 1.

[Drawing 6] It is an outline lineblock diagram showing the radio communications system concerning a 1st embodiment of this invention.

[Drawing 7] It is a block diagram showing the composition of the radio terminal 22 of drawing 6.

[Drawing 8] It is a flow chart which shows the procedure of the receiving operation of the radio terminal 22 of drawing 7.

[Drawing 9] It is a flow chart which shows the procedure of the send action of the radio terminal 22 of drawing 7.

[Drawing 10] It is a figure for explaining the method of the prioritization of a walkie-talkie.

[Drawing 11] It is an outline lineblock diagram of the communications system concerning a 2nd embodiment of this invention.

[Drawing 12] It is an outline lineblock diagram of the communications system concerning a 3rd embodiment of this invention.

[Drawing 13] It is an outline lineblock diagram of the communications system concerning a 4th embodiment of this invention.

[Drawing 14] It is an outline lineblock diagram of the communications system concerning a 5th embodiment of this invention.

[Drawing 15] It is a figure for explaining the communications system concerning a 6th embodiment of this invention.

[Drawing 16] It is a figure showing another composition of a 6th embodiment of this invention.

[Drawing 17]It is a block diagram showing drawing 15 and the example of composition of the radio terminal 92,120 of drawing 16.

[Drawing 18]It is a figure showing the example of composition of the conventional radio communications system.

[Drawing 19]It is a figure showing other examples of composition of the conventional radio communications system.

[Description of Notations]

10, 12, 14, 36, 38, 58, 72, and 86,120,150 Communications network

16, 18, 20, 40, 42, 54, 56, 68, 82, 94, 116, 124, 146, 1014, 1016, and 1048 Base transceiver station

22, 44, 50, 64, 78, 80, 92, 114, 122, 148, and 1004 Radio terminal

24, 26, 60, 96, 144, and 1042 Interface (internetwork-connection device)

28, 30, 32, 34, 74, 88, 1026, 1046 information servers

46 High-speed radio transmission line

48 Low-speed radio transmission line

52,142 House

62 Digital camera device

66 Building

70 Communications area

76 Bag

84 Automatic gate machine

90 Rail car

98 Communication control part

100 Table

102 Doctor

104,130 Communication end device

106,110,134 Communication terminal device

108,128 A fire department, emergency center

112,140 Authorized personnel, such as a relative

118 Service provider

126 Hospital

136 A fire department or an emergency center official in charge

138 Medical staff

152 Infrared sensor

154 Camera device

156-2204, 4403 acceleration sensors

158 Pulse wave sensor  
160-2205 position sensing devices  
162 Health-care information storage part  
164 Image processing portion  
166 User state judging part  
168 Communication control part  
170 Communication destination list  
172 Communication processing part  
174-2202 Radio receiving part  
176-2210 Wireless transmission part  
1000 PHS network  
1002 PDC network  
1006 Indicator  
1008 Ten key  
1010-1012 radio antennas  
1018-1052 Access server  
1020-1044 Internet  
1022-1024 and 1054 Communication destination terminal  
1028 PC device  
1028a PCMCIA card slot  
1028b Icon  
1028c Mouse cursor  
1030 PHS data communication card  
1032 Wireless LAN card device  
1034 PHS terminal  
1036 Main phone  
1038 Ethernet  
1040 Private network  
1050 PHS network  
2201 Communication control part  
2203 Battery  
2206 Terminal state judgment part  
2207-4402 Display  
2208 Input device  
2209 User application  
4401 Antenna



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